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19. BEHAVIOUR OF THE MALE GHARIAL DURING THE NESTING AND POST-HATCHING PERIOD

Introduction

During the first captive breeding of the gharial in 1980 (Bustard & Maharana 1980) observations were recorded on the behaviour of the male during nesting and incubation and also following hatching of the young. These data provide comparison with observations recorded elsewhere on other species of crocodilians. Del Toro (1969) and Hunt (1969), both reported on parental care in *Caiman crocodilus*. Del Toro stated that the male and female remained near the nest all the time permitting no one to approach. The male took the main defensive role. Both individuals watched the nest and its surroundings even when in the water. The male opened the nest and liberated the hatchlings while the female remained in the water calling to the young. Hunt noted that humans approaching the nest were not attacked. Both male and female occupied an area next to the nest by day and often the male guarded the nest at night. Neither parent opened the nest in response to croaking of the young. Hunt (1975) noted for *Crocodylus moreleti* that the mother crocodile chased other crocodiles except the dominant male away from the hatchlings, and that the dominant male chased all other crocodiles (in this mixed species display) except the two female *moreleti* out of the water but he allowed the hatchlings to bask on his back. Lever (1975) stated that in *C. porosus* the male assisted in nest defence in captivity and Lever and Balson (1978) recorded in *C. novaeguineae* that the male also helped to open the nest at hatching time and also picked up hatchlings in his jaws for transportation from the nest to the water.

Materials and Methods

Observations were recorded on the behaviour of a 3.8 m male gharial which had mated with a 3.17 m female gharial housed in an ideal breeding enclosure (Bustard & Maharana, in press), the pool of which measured 59.5 m x 29.7 m x 9.1 m in maximum depth.

Results

1. *At time of trial nesting*:

During the pre-nesting season, when the female emerged during the night to dig trial

nests, the male gharial was sometimes observed in the water near the edge of the pool adjacent to the area where the female was digging.

2. *When the female defended her nest* (against humans):

When the research staff approached the nesting sandbank, the female gharial immediately emerged from the water and approached the nest. At such times, if the male noticed this behaviour of the female, he swam to the edge adjacent to the pool where he kept watch.

Shortly before the eggs were due to hatch, the nest was excavated and 15 of the 25 eggs laid were removed for hatchery incubation. In order to prevent disturbance by the female during this operation, the water level in the pool was reduced by 1 m and staff were posted at the adjacent side of the pool to prevent the female emerging. During the entire operation, the female remained at this area, periodically trying to emerge, and the male also came to this edge of the pool. At no time during this operation or during the operation described above, did the male emerge from the water.

3. *At the time of opening the nest*:

The role of the male, if any, at the time of opening the nest by the female is not known as the actual nest opening was not observed.

4. *At the time of post-hatching parental care*:

The male contributed to post-hatching parental care by his periodic presence with the hatchling group. However, he at no time assisted the female in chasing away the other five adult/subadult female members of the group. The mother gharial did not tolerate other members of the group approaching the area of the pool where she remained with the hatchlings.

The hatchlings emerged from the nest on the morning of 7th May 1980. On 12 May 1980 the male was first observed to show an active interest in the hatchlings. The following observations were recorded :

1010 hours :

The male approached the female/hatchling group and came close to the hatchlings some of which were attempting to climb onto the female's back. The female showed no response to the male's close approach, in marked contrast to the behaviour exhibited towards any other members of the gharial group to approach this area of the pool which were chased off. A hatchling climbed onto the base of the male's tail and crawled up to bask on his back. The individual was followed by two further hatchlings, one of which basked on his head and the other on his back. The male cruised slowly towards the middle of the pool with the hatchlings basking on his body and returned to the location of the female and the remaining hatchlings:

Similar observations were observed extending over 15 minutes from 1620 hours.

13th May

At 0600 hours the male approached the female and hatchlings and floated near them. Two hatchlings climbed onto his head and back and three more floated near him in the water.

When the male came to the area of the female and hatchlings at 0700 hours several hatchlings climbed onto his back and head.

At 0745 hours, the male was carrying one hatchling on his back. The other five gharial remained at the opposite end of the pool. The male was observed visiting the female/hatchlings later in the morning and again in the afternoon.

Similar observations were observed on 14 May and again on 15 May when both the mother and the male were providing basking sites for the hatchlings on their heads and backs between 0900 and 1100 hours and again between 1300 and 1700 hours.

17th May

At 1700 when male approached the hatchlings, the mother gharial was lying outside the pool on the sand under the tree. Three hatchlings climbed onto his head and back. He remained with the hatchlings for 10 minutes.

18th May

At 1100 hours the male came to the group and three hatchlings basked on his back. Again at 1400 hours the male floated near the mother and some hatchlings came to the male and climbed onto his head and back. Other hatchlings were basking on the mother's back.

19th May

When the male came to the group at 0900 hours he gathered the hatchlings together by placing his body between them and the edge of the pool and slowly moving them backwards. This action, frequently seen by the female serves to aggregate the hatchlings. This is the only time that the male was observed to do this. He then floated with them for five minutes, with three hatchlings basking on his back, then returned to his favourite basking site in shallow water at the other end of the pool. After a further five minutes he returned to float near the mother and the hatchlings climbed onto his back and remained there for one and a half hours.

At 1600 hours the male again returned to the group and he floated with hatchlings on his head and back.

20th May

At 0900 hours the male came to the group and three hatchlings rode on his back. This was repeated at 1400 hours when two hatchlings rode on his back and head.

Similar observations were recorded during the period 21-30 May but at a lower intensity. Since this was equally true of the mother, it would appear that the constant protection afforded the hatchlings group by the female was waning, and with it the attention of the male.

Discussion

The male gharial played no part in nest-guarding unlike the observations recorded by both del Toro and Hunt for *Caiman crocodylus* and Lever (1975) for *C. porosus*. However, this behaviour agrees with that reported by Whitaker and Whitaker (1977) for the Indian mugger (*Crocodylus palustris*). Nor did the male gharial take part in nest opening, as described by del Toro (1969) for *Caiman crocodylus* and Lever and Balson (1978) for *C. novaeguineae*. However, the male gharial's role with the young is closely paralleled by the descriptions given by Hunt (1975) for *C. moreleti*.

It is noteworthy both that the male gharial showed interest in the hatchling group and that the brood-guarding mother allowed the male to closely approach the hatchlings and carry them on his back, observations paralleled by Hunt (1975) for *Crocodilus moreleti*. Similarly other members of the gharial group were not tolerated near the hatchlings. However, at other times all members of the group are extremely tolerant towards each other.

It is not known how far captive observations such as these can be extrapolated to nature. To date we know of no data demonstrating parental care by any male crocodilian in the wild other than the vigorous response shown by crocodilians of both sexes to the distress call of hatchlings. However, in the relatively confined space available in captivity as demonstrated above and also by del Toro (1969), Hunt (1969, 1973, 1975), Lever (1975) and Lever and Balson (1978), the male may share parental care duties with the female.

There may be considerable interspecific differences in parental care behaviour by either sex. This is strongly indicated for instance for *C. porosus* in the wild (Kar 1981) and by the differing parental care profiles of the two pairs of *Caiman crocodylus* reported on by del Toro (1969) and Hunt (1969).

As discussed by Bustard and Choudhury (1980) parental care, which clearly has survival value is also limited by the ability of the mother to efficiently protect the typically large hatchling brood. Any part of the parental care burden shared by the male, therefore, will further increase the survival value of parental care.

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20. GROWTH AND BEHAVIOUR OF A BLIND GHARIAL *GAVIALIS GANGETICUS* (GMELIN)

(*With a text-figure*)

INTRODUCTION

During the operation of a large-scale conservation programme for the gharial, we have incubated 1062 eggs collected from the Narayani and Kali rivers in Nepal and the Chambal river in Madhya Pradesh. Occurrence of eye defects, among a total of twelve types of congenital defects, was the most common for eggs collected from the Narayani-Kali-Gandaki rivers originating in Nepal (Singh and Bustard, in prepn.). The various eye defects ranged from simple defects relating only to ciliary muscles to complete absence of one, or more commonly, both eyes. Seven embryos developed without eyes four of which were found dead in the egg. In addition one embryo developed with only the left eye present. The individual reported on here is the only one to have survived. The present paper discusses the case history of the only surviving blind gharial, in particular its growth and behaviour from its hatching in June 1975 to January 1981 a period of about 6 years.

MATERIALS AND METHODS

The individual reported on here hatched from one of seventy-two eggs collected immediately following laying and incubated in hatchery conditions described by Singh (1978) and Bustard and Singh (in prep.). Besides 40 normal young, one young with defective umbilical constriction, and two, one dead and the other alive, with complete absence of eyes, were surgically removed from their eggs by the second author on 23rd June 1975 after a period of 76 days incubation. The surviving blind hatchling was the heaviest of the brood with a hatching weight of 94.8 g and length 36.0 cm against a mean weight of 75.3 g and length of 35.8 cm (N = 40). It had a normal amount of residual yolk. Along with the normal hatchlings the blind hatchling was reared under simulated natural conditions in captivity at the Gharial Research and Conservation Unit, Tikerpada. The normal rearing techniques are described by Bustard (in FAO 1975) and Singh (1978). The blind gharial was always kept in the same pool with its own hatchmates, ten in number, and trained to accept food from the hand ('hand-fed') from the age of three months. (In force-feeding the food is introduced into the mouth and pushed towards the throat when normal swallowing takes place).

OBSERVATIONS

1. *Swimming*: The blind gharial performed typical gharial swimming behaviour using the tail aided by the hind limbs. A peculiarity